A CHECKLIST OF SOME FISHES TAKEN WITH NEUSTON AND BONGO NETS IN THE VICINITY OF DEEPWATER DUMPSITE 106

by

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ABSTRACT

Fishes of more than 125 taxa were collected in neuston and bongo net tows from in and near Deepwater Dumpsite 106 during four seasonal cruises in 1978, and in bongo net tows taken 11 km north of the dumpsite during MARMAP I ichthyoplankton surveys from 1974 to 1976. Although myctophid fishes predominated, young stages of shelf-dwelling taxa occurred in the vicinity of the dumpsite on all cruises, indicating that transport off the shelf occurs throughout the year. Young stages of taxa from more southern latitudes were also common in the catches.

INTRODUCTION

This report is based on a series of site-specific studies to monitor the effects of ocean dumping at Deepwater Dumpsite 106, an area off the heavily industrialized northeast coast of the United States that was designated as a disposal site for industrial wastes by the Marine Protection Research and Sanctuaries Act of 1972 (Public Law 92-532). Deepwater Dumpsite 106 (DWD 106) is 170 km southeast of Ambrose Light and about 105 km east of Cape Henlopen, Delaware at 38°40'N to 39°00'N and 72°00'W to 72°30'W (Figure 1). Its center is about 170 km from the mean position of the Gulf Stream north wall and about 48 km from the edge of the shelf. Its area is 1295 km^2 and depth varies between 1300 and 2700 m although most of the site is over depths greater than 2000 m (Musick, 1975). Within the confines of DWD 106 is a smaller site that has been used for over 10 years as a dump for industrial waste (Pearce et al., 1975, 1977; Musick, 1975). Navigational charts also designated it as an explosives dump. South of the dumpsite and centered on coordinates 38°30'N and 72°06'W is a site of about 250 km^2 that has been used for the disposal of radioactive material (Dyer, 1975). Although there have been dumps of sewage sludge at DWD 106, most of the waste is of industiral origin. Bisagni et al. (1977) gave an account of the kinds, amounts, and origins of wastes dumped at the site in 1974 and 1975. More general information about DWD 106 can also be found in a recent Department of Commerce report (Anonymous, 1980).

Biological studies of waters in the vicinity of DWD 106 date back to the early work of Agassiz (1888), but there is still a paucity of information on the ichthyoplankton of the region. Musick (1975) reviewed historical biological studies and Warsh (1975) gave a general account of historical oceanographic information. It was not until the early 1970's that a specific program for a study of the dumpsite region was established. The initial work included a baseline report on ichthyoplankton taken at the dumpsite in May 1974 (Austin, 1975). In the ensuing years site characterization studies included ichthyoplankton collected on summer and winter cruises in 1972 (Sherman et al., 1977), and a brief account of neuston collections taken on a late summer cruise in 1976 (Haedrich, 1977).

This report expands the ichthyoplankton and neuston data bases for the DWD 106 region. These collections were made to provide specimens for testing the pathological and chemical effects of dumping on the biota

of the dumpsite. Since some of the analyses consumed the specimens, not all of the fishes collected are included in this report. Although this report does not provide a complete qualitative or quantitative register of all of the fishes from the four 1978 cruises, to my knowledge it is the first attempt to give a general characterization of the larval and juvenile fish community at the site for four consecutive seasons.

Funds were provided by Ocean Dumping Program (C3x4), NOS, NOAA (NOAA Task Number 871213) in support of NEFC's Ocean Pulse Program. Additional collections from 11 km north of the dumpsite between 1974 and 1976 were taken during MARMAP (Marine Resources Monitoring Assessment and Prediction) surveys which provide the principal source of information on the changing status of the nation's fishery resources.

SAMPLING STRATEGY

Dates of the four cruises in 1978 were set to take in account any seasonal differences in biota or oceanographic conditions in the analyses of the effects of dumping at DWD 106. The cruises were five to eight days long (Table 1). Figures 2-5 show the positions of net tows from which material was available for this report.

The general study pattern for each of the four cruises was similar. The major event was a prearranged dump of a bargeload of industrial waste. Before the dump, water samples and biological samples were taken for comparison with those taken during the experiment and to assure that the equipment was working properly. Some of these predump stations were outside the dumpsite beyond at least the immediate influence of dumpsite contaminants, but where other conditions were similar to those within the dumpsite. Other predump stations were in the dumpsite in the immediate vicinity of the impending dump, since this was the milieu for the experiment.

Dumps were arranged to be early in the day to take advantage of as much daylight as possible while tracking the disposal of the waste. Several devices were used to track and sample the waste plume as it dispersed. These included special acoustical equipment to provide information about the vertical dispersal, drogues with radar reflectors and lights, STD's, and a pump that could provide water samples from several depths simultaneously. Water samples were taken before and after the dump for later chemical analyses and comparison with data collected during the experiment.

Since collection of biological baseline information had been a major objective of past DWD 106 cruises, the major objective of the biological sampling in 1978 was to provide organisms for a variety of analyses, including chemical and pathological analyses of their tissues. A particular effort was made to collect fish eggs to determine the effects of wastes on their chromosomes. Such analyses require organisms of quite large size and/or in quite large numbers if the analyses are to provide reliable information. Given this objective and the labor intensive nature of the cruises, especially during

the hours immediately after a dump, it was found that the best collecting device available to use was the 0.5 x 1-meter neuston net. It collected large organisms as well as fish eggs and larvae, and did not require one of the winches to set the retrieve. Occasionally the bongo nets were towed for subsurface samples, usually in attempts to determine whether acoustic signals were coming from sunken waste or whether they had a biological origin.

Predictably, daylight catches in the neuston net were small, except when sargassum weed and its associated fauna was present, so most of the biological sampling was at night. Once the experiment began, the location of sampling was dictated by the location of the vessel as it tracked the waste plume.

Planktonic fish eggs and larvae drift in the sea with prevailing circulation patterns. The trajectories of water parcels as they move over the shelf and slope should be considered when analyzing the effects of ocean dumping.

To enlarge the checklist of ichthyoplankton that might occur in the vicinity of the dumpsite, additional material from 60 cm bongo net tows taken near DWD 106 on MARMAP surveys from 1974 to 1976 is included. All of it is from a station 11.2 km north of the dumpsite at 39°07'N and 72°11'W, or within the 1978 sampling area. Although no attempt is made in this paper to link ichthyoplankton and neuston to hydrography, circulation or contaminant loading, the additional time series of information might prove helpful in formulating future studies or making inferences on the impact of dumping.

METHODS

Two kinds of nets were used to collect the material. The neuston net is a 0.5 x 1-meter rectangular frame with a 0.505-mm mesh net. Ideally this net is towed half submerged at speeds of 1.5 to 3 knots. Usually we collected neuston samples throughout the night. While picking through a sample and removing and preserving organisms according to the requirements of the different investigations, the net was reset. Tow durations for the neuston net were 6 to 70 minutes. The bongo nets consist of two 61-cm diameter frames joined and towed side-by-side at about 1.5 to 2.5 knots (see Posgay and Marak, 1980). One frame is fitted with a 0.505-mm mesh net; the other with a 0.333-mm mesh net.

The bongo net tows were of two kinds. The kind used to collect the material on the 1978 cruises was a subsurface horizontal tow. The nets were lowered to the desired depth and towed for varying periods from 6 to 58 minutes. All of the supplemental material was collected by double-oblique bongo net tows. While the vessel proceeded at about 1.5 knots, the nets were lowered to about 200 m and immediately retrieved. The towing cable was let out at 50 m a minute and taken in at 20 m a minute. Such tows usually took between 15 and 25 minutes. For the supplemental collections, the nets were fitted with flow meters. This made it possible to calculate the amount of water strained and, in turn, to calculate the numbers of each organism caught under 102 m of surface. Although the 1978 material was taken from both the 0.505-mm and 0.333-mm bongo nets, the supplemental material was all from the 0.505-mm bongo nets.

Fishes are listed in Tables 6 and 7 according to the classification of Greenwood et al. (1966), except that it follows Weitzman (1974) for the gonostomatid, sternoptychid, and related fishes. The nomenclature takes into account name changes as compiled by Robins et al. (1980) and the amended spelling of family names suggested by Steyskal (1980).

Specimens are listed in the tables as larvae (L), juveniles (J), or adults (A). For most specimens the status was obvious, but for some their assignment to one of these categories was somewhat subjective, especially the distinction between juvenile and adult. For the myctophid fishes, this information is from Gibbs et al. (1971) and Nafpaktitis et al. (1977).

Lengths are in millimeters and were measured from the tip of the snout to the tip of the notochord on young specimens. On specimens with the caudal structure developed, length was measured from the tip of the snout to the posterior edge of the hypural elements. The lengths of the supplemental material were recorded as falling within a range of one millimeter, e.g. 3.0-3.9 or 11.0-11.9. These lengths are listed in the tables to the half millimeter, e.g. 3.5 or 11.5.

Identifications relied on standard works. These include Anderson et al. (1966), Aprieto (1974), Berry (1959), Berry and Vogele (1961), Bigelow and Schroeder (1953), Böhlke and Chapman (1968), Caldwell (1962), Cohen and Nielsen (1978), Fahay (1975), Fahay and Obenchain (1978), Gibbs (1964), Grey (1964), Gutherz (1970), Jordan and Evermann (1896-1900), Kendall (1972, 1979), Leiby (1981), Leim and Scott (1966), Moore (1967), Nafpaktitis et al. (1977), Rofen (1966), Russell (1976), and Smith (1979).

RESULTS AND DISCUSSION

About 125 taxa are represented in bongo and neuston catches from the seasonal dumpsite cruises (Table 6) and in the supplemental material (Table 8). Catches from each of the seasonal cruises are listed in Tables 2 through 5 and catches for each of the cruises on which the supplemental material was collected are listed in Table 7. If consideration is given to differences in the gear used to collect the material, the fishes in the 1978 and supplemental material are similar to those listed in other reports, e.g. Anonymous (1977b), Austin (1975), Haedrich (1977), Krueger et al. (1975), Krueger et al. (1977), and Sherman et al. (1977).

In Tables 6 and 8, those taxa with a single checkmark (✓), 27 taxa, are the young stages of shelf fishes (e.g. Urophycis spp., Ammodytes sp., and Lophius americanus) and those taxa with two checkmarks (✓✓), 15 taxa, are the young stages of taxa commonly found at latitudes south of the dumpsite (e.g. Abudefduf saxatilis and scarid fishes). Taxa with no checkmark, 83 taxa, spend their lives or the early stages of their lives beyond the shelf edge (e.g. myctophid fishes and paralepidid fishes).

The family Myctophidae is abundant and important in offshore waters (Moser and Ahlstrom, 1970) and represents an important part of the material available from DWD 106 as well. More than a third of the 1533 specimens are myctophid fishes. At least 25 species are represented and the species represent six of the nine zoogeographic distribution patterns described by Backus et al. (1977).

The occurrence of taxa from three marine ecosystems (i.e. shelf, slope, and southern) and the variety of myctophid fishes found at the dumpsite reflect the complex oceanographic conditions at the site. These conditions were described by Goulet and Hausknecht (1977), Ingham et al. (1977), and Warsh (1975). Perhaps the most dramatic oceanographic phenomena are the occasional seaward excursions of the shelf-slope front (Ingham et al., 1977) and the irregular but frequent passage of anticyclonic warm-core Gulf Stream eddies through the dumpsite area (Bisagni, 1976). The former event could account for the occurrence of larvae of shelf species at the dumpsite while the latter could provide the means for transporting southern taxa into the area. Celone and Chamberlin (1980) gave an account of 11 such eddies off the southern New England and Middle Atlantic coasts in 1978. According to their data, eddies were close to or in the dumpsite during the fall and winter cruises of 1978. Oceanographic data collected during these cruises tend to confirm their presence in and around the dumpsite (Bisagni, pers. comm.).

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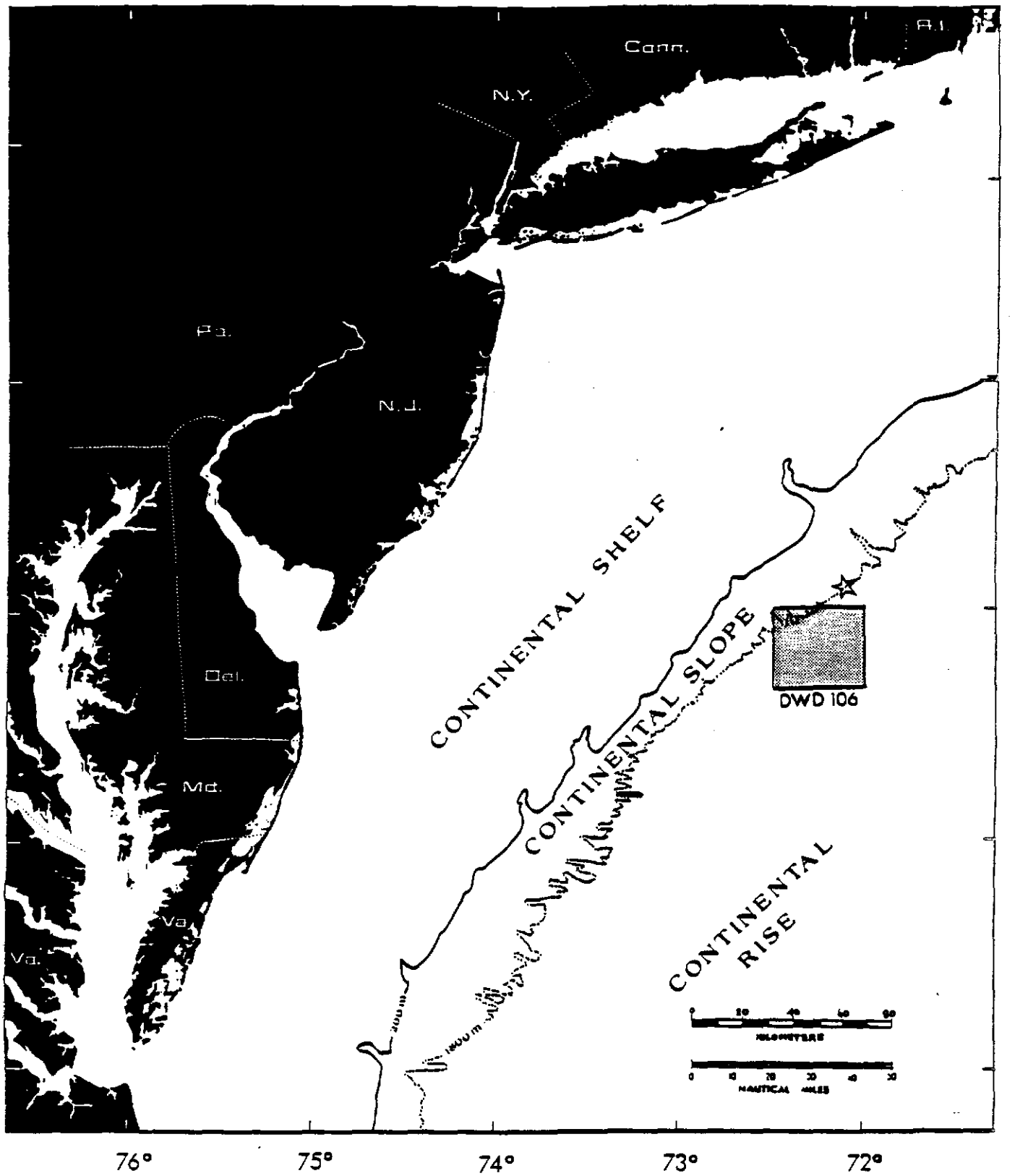

Figure 1. Location of Deepwater Dumpsite 106 in relation to the coast and ocean bottom features. The star indicates the location of the station where the ichthyoplankton and neuston samples were taken from 1974 to 1976 (after Pearce et al., 1977).

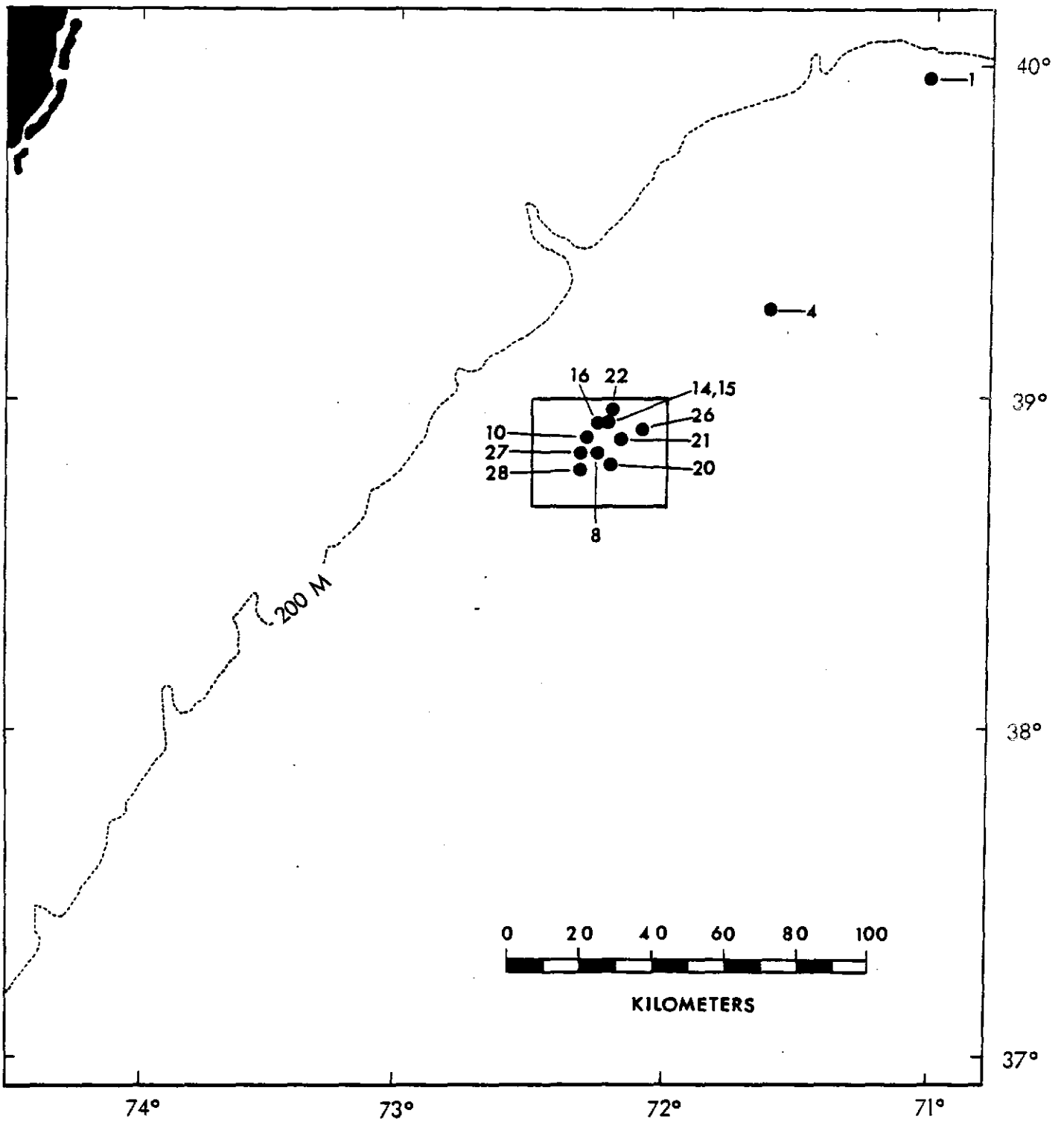

Figure 2. Location of stations from which fishes where available from the Deepwater Dumpsite 106 cruise of January-February 1978.

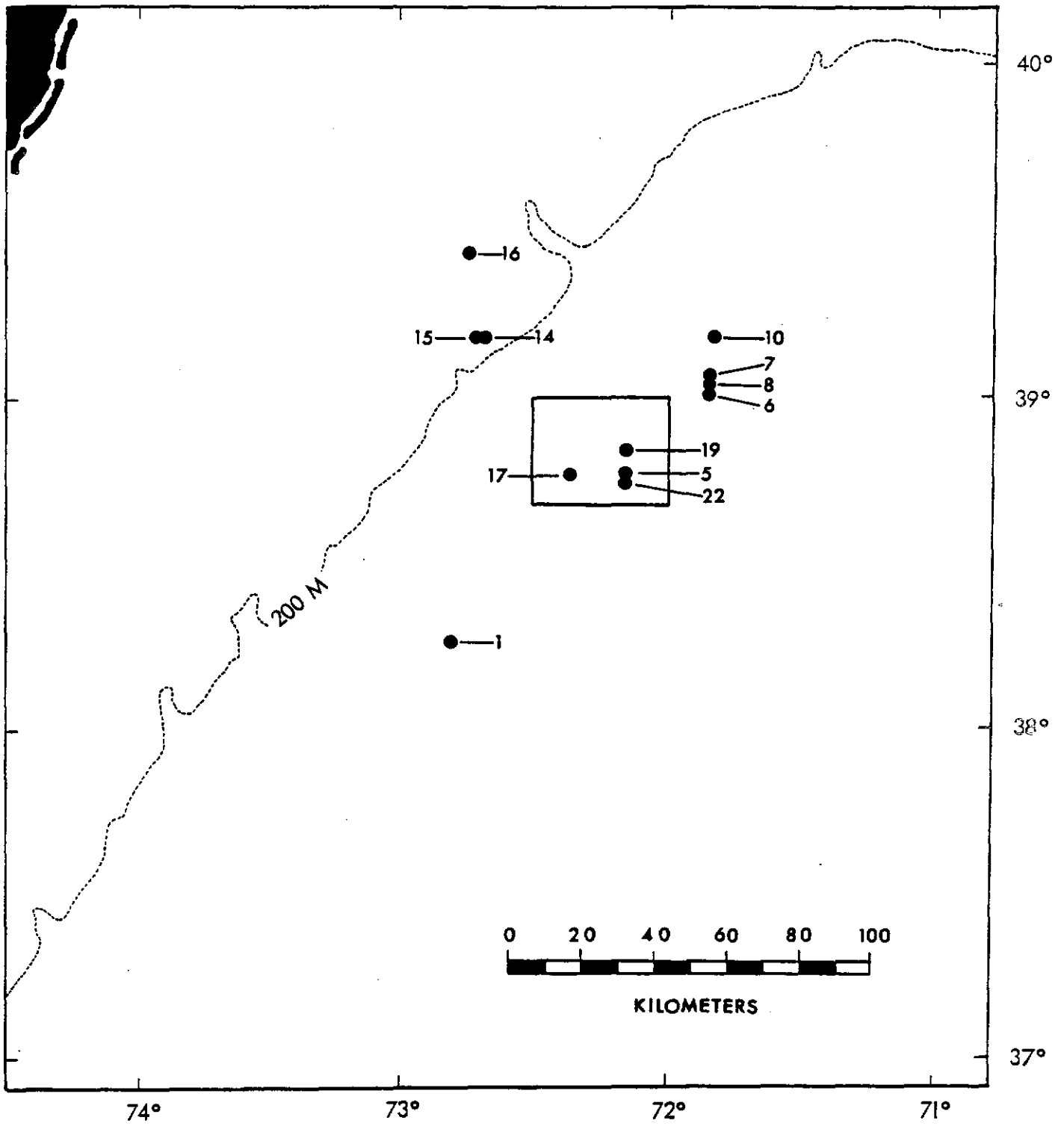

Figure 3. Location of stations from which fishes were available from the Deepwater Dumpsite 106 cruise of April 1978.

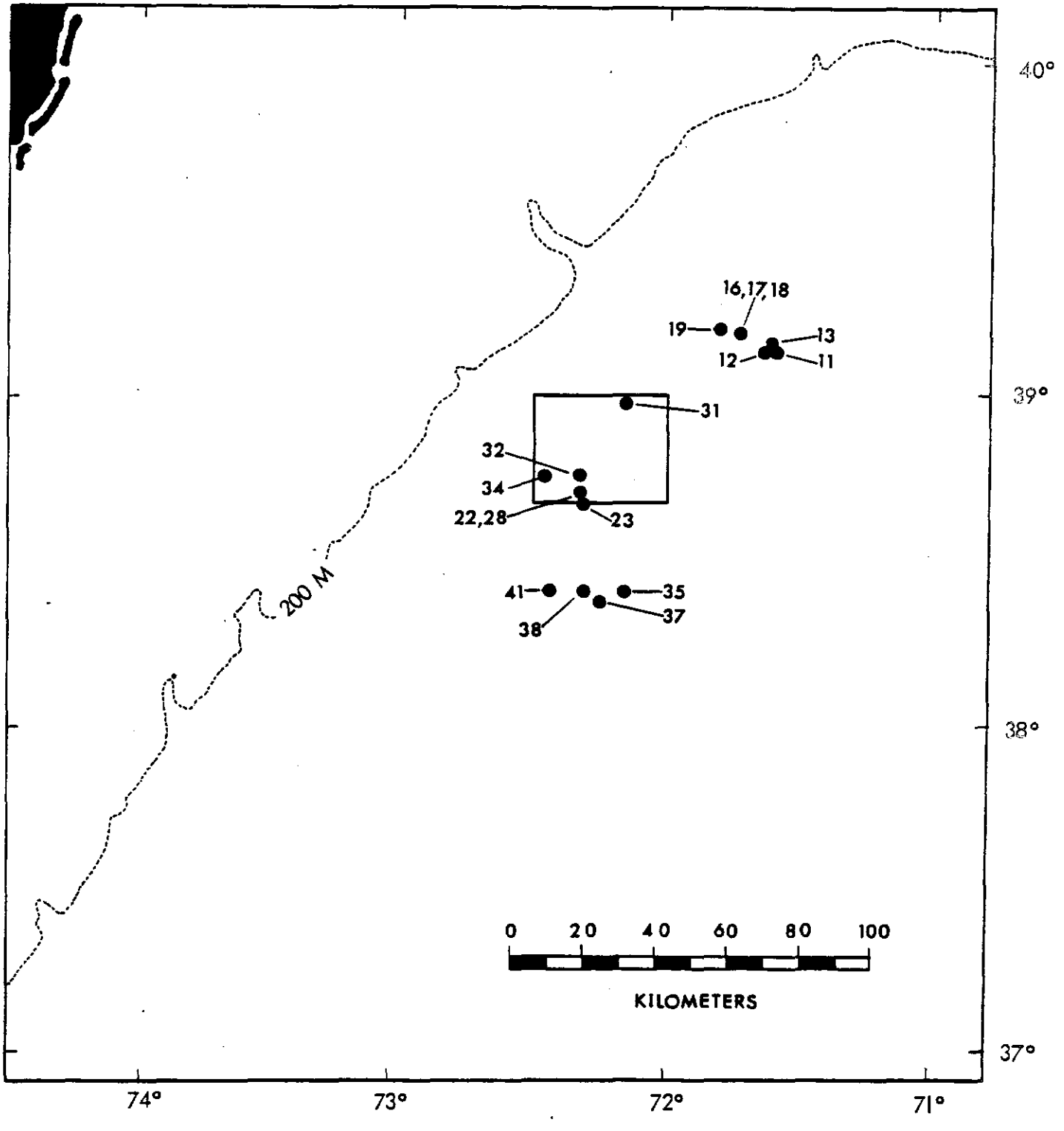

Figure 4. Location of stations from which fishes were available from the Deepwater Dumpsite 106 cruise of June 1978.

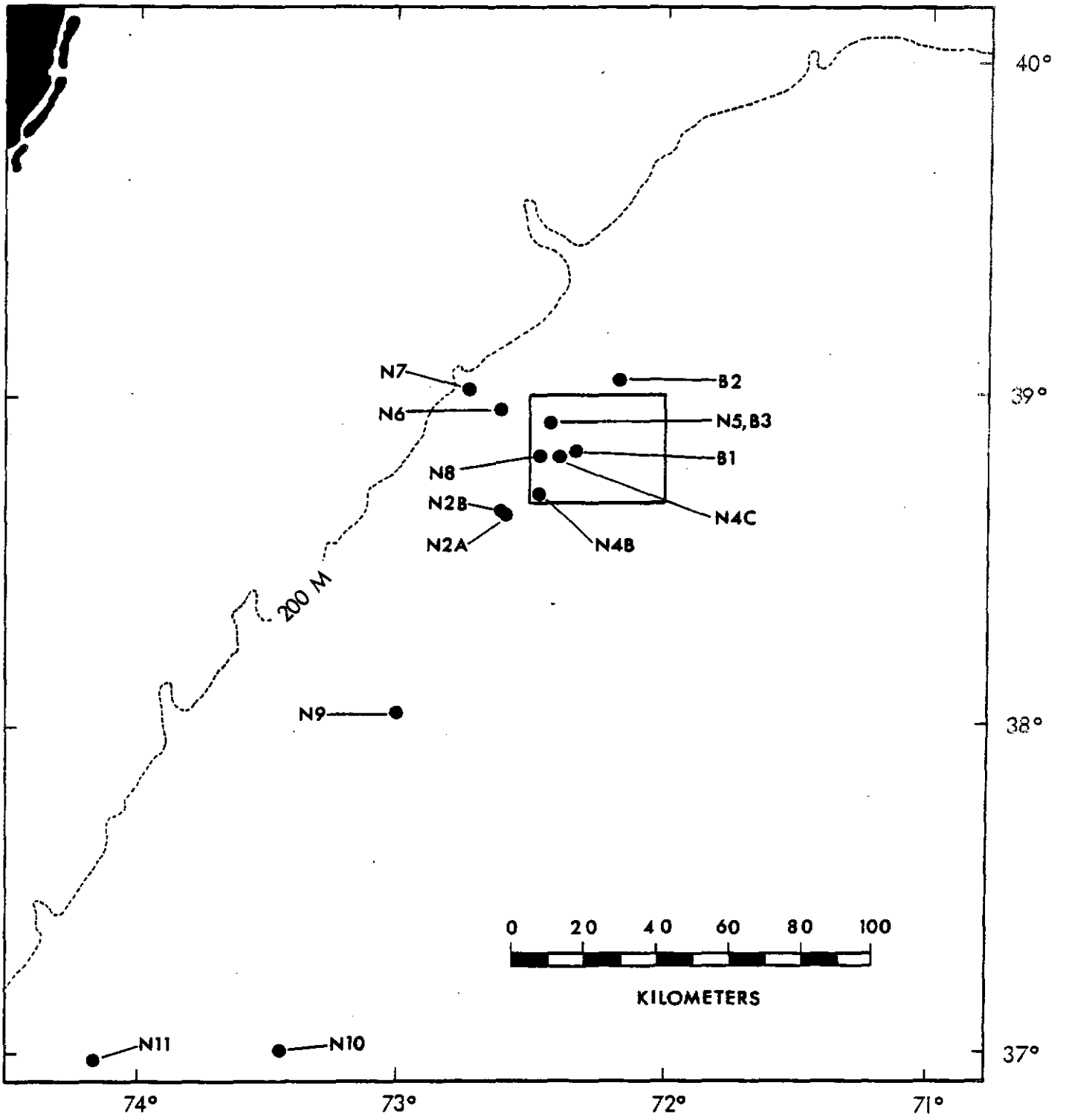

Figure 5. Location of stations from which fishes were available from the Deepwater Dumpsite 106 cruise of November 1978.

Table 1. Station data for the 1978 cruises to Deepwater Dumpsite 106. Only those stations from which samples were used for this report are listed. Positions are in latitude north and longitude west. Times and dates are in Greenwich Mean Time. Depths are in meters (0 indicates a surface tow).

Station	Date	Time	Position	Gear	Depth
Winter cruise, Albatross IV 78-01					
1	30-I-78	0108-0137	39°59'-71°01'	neuston	0
4	30-I-78	1022-1121	39°18'-71°45'	neuston	0
8	2-II-78	0053-0153	38°50'-72°15'	neuston	0
10	2-II-78	0647-0747	38°53'-72°19'	neuston	0
14	2-II-78	2322-2353	38°56'-72°10'	neuston	0
15	3-II-78	0001-0037	38°56'-72°10'	neuston	0
16	3-II-78	0306-0403	38°56'-72°11'	neuston	0
20	3/4-II-78	2335-0033	38°48'-72°13'	bongo	0
21	4-II-78	0246-0348	38°54'-72°10'	neuston	0
22	4-II-78	0357-0501	38°58'-72°09'	neuston	0
26	5-II-78	0042-0112	38°56'-72°07'	neuston	0
27	5-II-78	0730-0811	38°52'-72°21'	neuston	0
28	5-II-78	0817-0918	38°47'-72°21'	neuston	0
Spring cruise, Mt. Mitchill S-C509-MI-78 78					
1	6-IV-78	1122-1152	38°17'-72°42'	neuston	0
5	7-IV-78	0616-0646	38°45'-72°08'	neuston	0
6	8-IV-78	0112-0142	38°59'-71°51'	neuston	0
7	8-IV-78	0155-0225	39°01'-71°51'	neuston	0
8	8-IV-78	0237-0307	39°02'-71°51'	neuston	0
10	8-IV-78	0512-0542	39°09'-71°50'	neuston	0
14	8-IV-78	1701-1731	39°09'-72°40'	neuston	0
15	8-IV-78	1752-1852	39°09'-72°41'	neuston	0
16	9-IV-78	0039-0139	39°24'-72°41'	neuston	0
17	10-IV-78	0338-0438	38°45'-72°20'	neuston	0
19	11-IV-78	0046-0146	38°50'-72°08'	neuston	0
22	12/13-IV-78	2327-0037	38°45'-72°08'	neuston	0
Summer cruise, George B. Kelez S-C512-KE-78					
11	13-VI-78	0110-0128	39°06'-71°39'	bongo	23
12	13-VI-78	0157-0214	39°06'-71°40'	bongo	28
13	13-VI-78	0226-0243	39°07'-71°41'	bongo	26
16	13-VI-78	0515-0521	39°10'-71°47'	neuston	0
17	13-VI-78	0521-0134	39°10-71°47'	neuston	0
18	13-VI-78	0540-0638	39°10-71°47'	neuston	0
19	13-VI-78	0642-0749	39°11'-71°48'	neuston	0
22	13-VI-78	1804-1857	38°41'-72°19'	neuston	0
23	13-VI-78	1902-1947	38°40'-72°18'	neuston	0
28	14-VI-78	0230-0316	38°41'-72°19'	neuston	0
31	14-VI-78	0803-0912	38°59'-72°08'	neuston	0
32	15-VI-78	0208-0317	38°45'-72°18'	neuston	0
34	15-VI-78	1449-1544	38°44'-72°26'	neuston	0
35	16-VI-78	0143-0201	38°24'-72°09'	bongo	242
37	16-VI-78	0310-0328	38°22"-72°13'	bongo	225
38	16-VI-78	0413-0425	38°24'-72°17'	neuston	0
41	16-VI-78	0615-0711	38°26'-72°23'	neuston	0
Fall cruise, Mt. Mitchill S-C517-MI-78					
N2A	14-XI-78	1915-1945	38°38'-72°33'	neuston	0
N2B	14-XI-78	1950-2025	38°39'-72°34'	neuston	0
B1	14-XI-78	2322-2342	38°48'-72°19'	bongo	47
B2	15-XI-78	0550-0610	39°03'-72°07'	bongo	160
N4B	16-XI-78	0150-0215	38°48'-72°26'	neuston	0
N4C	16-XI-78	0340-0400	38°48'-72°21'	neuston	0
N5	16-XI-78	1925-1950	38°55'-72°23'	neuston	0
B3	16-XI-78	1930-1950	38°55'-72°23'	bongo	0
N6	17-XI-78	0458-0518	38°57'-72°33'	neuston	0
N7	17-XI-78	2250-2310	39°01'-72°43'	neuston	0
N8	18-XI-78	0500-0520	38°39'-72°27'	neuston	0
N9	18-XI-78	0850-0915	38°03'-72°58'	neuston	0
N10	18-XI-78	1705-1725	36°59'-73°29'	neuston	0
N11	18-XI-78	2300-2325	37°00'-74°13'	neuston	0

Table 2. List of fishes from the January-February cruise to Deepwater Dumpsite 106. The stages (L=larval, J=juvenile, A=adult) and the size range (lengths in millimeters) follow each taxon.

Station	Taxon	Number and Stage	Size Range
1	*Myctophum punctatum*	6A	60.4-68.0
4	*Diaphus dumerilii*	1A	44.2
4	*Gonichthys cocco*	4A	33.2-46.0
8	*Myctophum affine*	1A	52.0
8	*Myctophum punctatum*	2A	53.5-61.7
8	*Notoscopelus resplendens*	1A	58.0
8	*Symbolophorus veranyi*	1J,1A	24.2-105.5
10	*Diaphus dumerilii*	4A	41.0-45.5
10	*Symbolophorus veranyi*	2A	92.2-107.3
14	*Daiphus dumerilii*	1A	50.4
14	*Myctophum punctatum*	2A	50.9-50.9
15	*Astronesthes niger*	1A	43.2
16	*Astronesthes niger*	2A	50.2-61.0
16	*Centrobranchus nigroocellatus*	1J	14.5
16	*Diaphus dumerilii*	1A	53.0
16	*Gonichthys cocco*	2J,1A	18.0-40.5
16	*Myctophum punctatum*	5A	56.3-59.4
16	*Notoscopelus resplendens*	2A	52.9-60.8
16	*Symbolophorus veranyi*	2A	53.6-110.5
20	*Diaphus dumerilii*	1A	62.4
20	*Gonichthys cocco*	1J	20.2
20	*Myctophum affine*	3J	15.3-18.1
20	*Myctophum obtusirostre*	2J	16.8-19.6
20	*Myctophum punctatum*	5A	55.2-58.2
20	*Symbolophorus veranyi*	1J,1A	25.6-52.1
20	*Urophycis* sp(p)	6L	11.9-19.9
20	*Mugil curema*	2J	21.0-21.4
21	*Ceratoscopelus maderensis*	1J	28.2
21	*Myctophum affine*	1J	21.2
21	*Myctophum asperum*	3J	14.0-18.0
21	*Myctophum obtusirostre*	2J	15.5-17.8
21	*Myctophum punctatum*	4A	56.3-65.5
21	*Notoscopelus resplendens*	1A	61.8
21	*Symbolophorus veranyi*	4J,2A	24.8-84.5
21	*Mugil cephalus*	3J	20.2-21.2
22	*Daiphus dumerilii*	1A	55.2
22	*Gonichthys cocco*	6J,3A	18.1-48.6
22	*Hygophum hygomi*	1J	17.5
22	*Myctophum asperum*	1J	17.0
22	*Myctophum nitidulum*	6J	16.0-26.5
22	*Myctophum obtusirostre*	5J	14.5-24.8
22	*Myctophum punctatum*	4A	58.2-61.5
22	*Symbolophorus veranyi*	13J	23.5-36.5
26	*Gonichthys cocco*	1A	35.3
26	*Myctophum punctatum*	2A	56.1-59.0
26	*Symbolophorus veranyi*	1A	103.6
27	*Centrobranchus nigroocellatus*	3J	13.0-15.0
27	*Diaphus dumerilii*	4J	43.3-50.5
27	*Gonichthys cocco*	8J,1A	19.0-33.8
27	*Myctophum asperum*	3J	15.0-16.2
27	*Myctophum nitidulum*	6J	16.0-26.5
27	*Myctophum obtusirostre*	5J	14.5-16.1
27	*Myctophum punctatum*	4A	58.2-61.5
27	*Symbolophorus veranyi*	3J	24.2-51.0
28	*Centrobranchus nigroocellatus*	1A	30.7
28	*Daiphus dumerilii*	8J,1A	42.1-53.5
28	*Gonichthys cocco*	5J	18.2-20.0
28	*Hygophum hygomi*	1J	16.2
28	*Myctophum affine*	2J	39.1-43.6
28	*Myctophum asperum*	4J	13.5-20.8
28	*Myctophum nitidulum*	6J	15.2-34.5
28	*Myctophum obtusirostre*	2J	15.4-16.1
28	*Myctophum punctatum*	8A	54.2-64.3

Table 3. List of fishes from the April cruise to Deepwater Dumpsite 106. The stages (L=larval, J=juvenile, A=adult) and the size range (lengths in millimeters) follow each taxon.

Station	Taxon	Number and Stage	Size Range
1	*Urophycis* sp(p)	5L	4.3-5.0
1	*Hippocampus erectus*	1A	ca 50
1	*Peprilus triacanthus*	6L	5.6-7.9
1	*Bothus* sp	1L	12.9
5	*Anguilla rostrata*	3L	55.8-58.6
5	*Myctophum punctatum*	3A	55.2-65.1
5	*Symbolophorus veranyi*	1J	30.8
5	*Scomberesox saurus*	1J	74.8
5	*Mugil cephalus*	1J	21.1
6	*Myctophum asperum*	1J	17.0
6	*Myctophum punctatum*	1A	57.3
6	*Notolychnus valdivae*	2A	17.0-19.9
6	*Symbolophorus veranyi*	3J	30.0-32.6
7	*Myctophum punctatum*	6A	53.0-65.2
7	*Myctophum* sp	1L	8.5
7	*Symbolophorus veranyi*	3J	26.1-30.9
8	*Myctophum punctatum*	2A	59.0-65.0
10	*Benthosema glaciale*	1A	55.4
10	*Symbolophorus veranyi*	2J	24.2-27.1
14	*Ammodytes* sp	17L	11.0-17.3
15	*Ammodytes* sp	4L	9.8-15.5
16	*Lophius americanus*	1L	12.5
16	*Ammodytes* sp	155L	15.0-25.0
17	*Engraulis eurystole*	1J	31.0
17	*Saurenchelys cancrivora?*	1L	116.0
17	*Diaphus taaningi*	1J	25.5
17	*Myctophum punctatum*	9A	54.3-64.2
17	*Symbolophorus veranyi*	1J	32.1
17	*Mugil cephalus*	1J	27.0
19	*Ophichthus melanoporus*	1L	65.0
19	*Saurida* sp?	1L	10.2
19	*Hygophum hygomi*	3A	28.6-36.8
19	Myctophidae sp(p)	3L	5.0-7.6
19	*Myctophum punctatum*	9A	54.9-66.0
19	*Symbolophorus veranyi*	3J	26.9-35.0
19	*Lophius americanus*	2L	4.8-5.0
19	Antennariidae sp	1L	4.5
19	*Carapus bermudensis*	1L	-
19	Macrouridae sp	2L	4.1-4.6
19	*Prionotus* sp	1L	5.7
19	Scorpaenidae sp	2L	5.6-7.0
19	*Centropristis striata*	1L	3.9
19	*Diplectrum* sp	1L	8.0
19	*Citharichthys* sp	2L	4.2-9.4
19	*Ammodytes* sp	2L	-
22	*Merluccius bilinearis*	1L	3.3
22	*Urophycis* sp(p)	3L	4.0-5.6
22	*Peprilus triacanthus*	4L,1J	6.8-19.3
22	*Bothus* sp	1L	19.2

Table 4. List of fishes from the June cruise to Deepwater Dumpsite 106. The stages (L=larval, J=juvenile, A=adult) and the size range (lengths in millimeters) follow each taxon.

Station	Taxon	Number and Stage	Size Range
11	*Hygophum* sp	1L	7.7
11	Myctophidae sp	1L	6.4
11	*Lophius americanus*	4L	4.5-6.1
12	*Benthosema glaciale*	1J	15.5
12	*Diaphus dumerilii*	1J	19.0
12	*Hygophum hygomii*	1A	32.4
13	*Notolepis rissoi*	2L	18.8-27.0
13	*Benthosema glaciale*	1J	15.5
13	*Ceratoscopelus maderensis*	1L	11.7
13	*Diaphus dumerilii*	1J	19.0
13	*Hygophum hygomi*	1A	32.4
13	Myctophidae sp(p)	8L	5.4-10.2
16	*Centrobranchus nigroocellatus*	2J	15.0-15.2
16	*Gonichthys cocco*	1J	20.4
16	*Myctophum affine*	18J	15.5-24.2
16	*Myctophum nitidulum*	2J	17.5-24.5
16	*Symbolophorus veranyi*	1J	41.8
17	*Centrobranchus nigroocellatus*	3J	15.0-21.1
17	*Gonichthys cocco*	1A	36.6
17	*Myctophum affine*	3J	16.8-18.8
17	*Myctophum nitidulum*	2J,2A	14.6-45.8
17	*Scomberesox saurus*	1J	87.5
18	*Gonichthys cocco*	4J	19.3-21.4
18	*Myctophum affine*	32J,1A	14.6-47.5
18	*Myctophum asperum*	4J	19.5-22.5
18	*Symbolophorus veranyi*	2J	34.0-38.6
18	*Urophycis* sp(p)	4J	13.7-30.4
18	*Scomberesox saurus*	1L	29.5
18	*Mugil cephalus*	1J	25.0
19	*Urophycis* sp(p)	2J	15.2-33.5
19	*Seriola fasciata?*	1J	22.8
19	*Mygil cephalus*	1J	22.3
19	*Mugil curema*	3J	18.2-24.6
19	*Parablennius marmoreus?*	1J	19.8
19	*Monacanthus hispidus*	2J	15.3-16.5
19	*Sphoeroides* sp	3J	8.9-14.5
22	*Urophycis* sp(p)	3L	9.8-10.4
22	*Monacanthus hispidus*	1J	25.2
22	*Sphoeroides* sp	9J	8.4-10.5
23	*Canthidermis sufflamen*	1J	31.2
23	*Monacanthus hispidus*	4J	23.5-40.0
23	*Sphoeroides* sp	12J	7.7-11.8
28	*Gonichthys cocco*	4J	19.0-25.7
28	*Myctophum affine*	1J	22.5
28	*Myctophum nitidulum*	2J	18.4-18.8
28	*Urophycis* sp(p)	2L,6J	6.9-22.5
28	*Scomberesox saurus*	1L	16.0

Table 4. (continued)

Station	Taxon	Number and Stage	Size Range
31	*Gonichthys cocco*	1A	39.5
31	*Myctophum affine*	1J	22.5
31	*Symbolophorus veranyi*	1J	50.8
31	*Urophycis* sp(p)	4L,6J	8.0-17.5
31	*Scomberesox saurus*	1J	29.5
31	*Pomatomus saltatrix*	1J	23.2
31	*Seriola fasciata?*	2J	21.0-24.3
31	*Seriola zonata?*	1J	30.2
31	*Mugil curema*	1J	20.5
31	*Peprilus triacanthus*	1J	15.0
31	*Monacanthus hispidus*	2J	38.0-43.5
32	*Gonichthys cocco*	2A	37.2-38.5
32	*Sumbolophorus veranyi*	1A	101.0
32	*Scomberesox saurus*	1J	39.4
32	*Pomatomus saltatrix*	1J	29.2
32	*Seriola fasciata?*	1J	24.4
32	*Monacanthus hispidus*	3J	30.1-39.4
34	*Sphoeroides* sp	2J	13.0-15.2
35	*Benthosema glaciale*	1J	12.7
35	*Gonichthys cocco*	1J	22.0
35	*Hygophum taaningi*	1J	26.0
37	*Gonostoma elongatum*	2L	7.1-7.5
37	*Benthosema glaciale*	2L,2J,1A	6.1-3.8
37	*Ceratoscopelus maderensis*	15L	5.0-9.2
37	*Hygophum* sp	4L	5.9-6.5
37	*Lampanyctus* sp	1L	4.5
37	*Lepidophanes guentheri*	1L	18.0
37	Myctophidae sp(p)	4L	4.0-5.9
38	*Centrobranchus nigroocellatus*	1J	21.4
38	*Ceratoscopelus maderensis*	1L	6.7
38	*Gonichthys cocco*	6J,11A	19.0-38.0
38	*Hygophum reinhardtii*	1J	12.9
38	*Myctophum asperum*	1J	16.9
38	*Myctophum nitidulum*	5J	13.0-25.2
38	*Urophycis* sp(p)	5L,5J	6.9-14.0
38	*Sphoeroides* sp	1J	10.2
41	*Gonichthys cocco*	10A	27.1-41.2
41	*Myctophum affine*	5J	23.5-38.4
41	*Myctophum nitidulum*	5J	22.7-29.0
41	*Myctophum selenops*	1A	25.6
41	*Prognichthys gibbifrons*	1J	37.5
41	*Scomberesox saurus*	2J	17.5-34.5
41	*Oligoplites saurus*	1J	10.8
41	*Seriola dumerili?*	1J	19.5-22.0
41	*Monacanthus hispidus*	2J	21.2-25.3

Table 5. List of fishes from the November cruise to Deepwater Dumpsite 106. The stages (L=larvae, J=juvenile, A=adults) and the size range (lengths in millimeters) follow each taxon.

Station	Taxon	Number and Stage	Size Range
N2A	*Urophycis* sp(p)	14L,2J	5.1-16.0
N2A	*Abudefduf saxatilus*	1J	18.6
N2A	*Monacanthus hispidus*	2J	22.0-27.7
N2A	*Sphoeroides* sp	7J	6.0-11.7
N2B	*Urophycis* sp(p)	116L,25J	5.9-21.2
N2B	*Seriola* sp	2L	8.4-10.1
N2B	*Mullus auratus*	1L,4J	7.5-10.7
N2B	*Mugil curema*	1L	7.0
N2B	*Canthidermis sufflamen*	1J	18.2
N2B	*Monacanthus hispidus*	1J	23.0
N2B	*Sphoeroides* sp	17J	5.7-12.2
B1	*Benthosema suborbitale*	1J	14.6
B1	*Ceratoscopelus maderensis*	2J	22.4-22.8
B1	*Diaphus dumerilii*	1J	20.2
B1	*Diogenichthys atlanticus*	2J	12.5-15.3
B1	*Lepidophanes guentheri*	1J	28.4
B1	*Myctophum* sp	1L	6.2
B1	**Serranidae**	2L	6.2-8.0
B1	**Labridae** sp(p)	3L	6.2-6.7
B1	**Scaridae** sp	2L	6.5-7.0
B1	*Callionymus*	2L	2.7-3.0
B1	**Gobiidae** sp(p)	3L	4.8-8.1
B1	*Bothus* sp(p)	5L	3.8-7.6
B2	**Congridae** sp	1L	50.2
B2	*Vinciguerria nimbaria*	2L	9.0-13.8
B2	*Sudis hyalina*	1L	12.4
B2	*Ceratoscopelus maderensis*	19L	6.5-11.5
B2	*Ceratoscopelus warmingi*	2L	8.7-8.8
B2	*Diaphus dumerilii*	1J	16.8
B2	*Diaphus rafinesquii*	1J	11.5
B2	*Diaphus taaningi*	1L,1J	9.7-12.7
B2	*Hygophum benoiti*	3J	11.3-32.8
B2	*Lampanyctus alatus*	1J	17.3
B2	*Lepidophanes guentheri*	1J	18.0
B2	*Notolychnus valdivae*	1J	11.9
B2	*Symbolophorus veranyi*	1J	15.0
B2	*Enchelyopus cimbrius*	1J	13.1
B2	*Carapus bermudensis*	1L	67.5
B2	**Scaridae** sp(p)	3L	7.3-7.9
B2	**Gobiidae** spp	2L	7.3-8.0
B2	*Diplospinus multistriatus*	1L	10.6
B2	**Trichiuridae**	1L	10.3
B2	*Bothus* sp(p)	5L	5.4-9.7
B2	*Etropus microstomus?*	1L	4.5
B2	*Syacium papillosum*	2L	6.4-6.7
B2	*Symphurus* sp	1L	7.0
N4B	*Harengula jaguana?*	2L	14.5-14.8
N4B	**Synodontidae** sp	1L	9.4
N4B	*Lestidium atlanticum*	1L	22.0
N4B	*Gonichthys cocco*	2J,18A	22.4-40.8
N4B	*Myctophum affine*	1J,4A	18.3-52.0
N4B	*Euleptorhamphus velox*	1J	35.8
N4B	*Urophycis* sp(p)	6J	9.4-17.8
N4B	*Mugil curema*	2J	10.8-20.9
N4B	**Scaridae** sp	1L	5.0
N4B	*Bothus* sp(p)	4L	4.3-8.2
N4B	*Syacium papillosum*	1L	6.4
N4C	*Engraulis eurystole*	1L	22.5
N4C	*Gonichthys cocco*	1J,6A	19.5-46.3
N4C	*Hygophum benoiti*	1J	28.5

Table 5. Continued.

Station	Taxon	Number and Stage	Size Range
N4C	*Hygophum reinhardtii*	2J	12.8-22.0
N4C	*Myctophum affine*	9J,2A	18.2-51.9
N4C	*Urophycis* sp(p)	4J	15.3-20.8
N4C	*Seriola dumerili*	3J	28.0-48.5
N4C	*Coryphaena hippurus*	1J	21.0
N4C	*Mugil curema*	1J	12.6
N4C	Labridae	1L	9.3
N4C	*Bothus* sp(p)	4L	8.2-8.7
N4C	*Etropus microstomus*	1L	7.4
N4C	*Syacium papillosum*	1L	6.8
N4C	*Monacanthus hispidus*	2J	17.0-20.0
N4C	*Sphoeroides* sp	1J	7.4
N5	*Hygophum* sp	1J	-
N5	*Urophycis* sp(p)	57L,312J	3.8-22.5
N5	*Balistes capriscus*	1J	24.0
N5	*Sphoeroides* sp	10J	7.5-13.2
B3	*Anguilla rostrata*	2L	26.4-49.9
B3	*Notolepis rissoi*	1L	18.0
B3	*Diaphus* sp	1L	7.4
B3	*Carapus bermudensis*	4L	42.5-105.0
B3	Labridae sp	1L	8.0
B3	*Bothus* sp(p)	3L	4.7-11.5
N6	*Engarulis eurystole*	2L	21.5-26.0
N6	*Gonichthys cocco*	1J,1A	18.3-31.0
N6	*Cypselurus melanurus*	1J	90.0
N6	Syngnathidae sp	1J	40.1
N6	*Coryphaena hippurus*	2J	35.0-44.8
N6	*Eucinostoma gula?*	5L	9.4-11.0
N6	*Monacanthus hispidus*	1J	18.2
N7	*Centrobranchus nigroocellatus*	1J	17.7
N7	*Gonichthys cocco*	1J,2A	21.4-55.1
N7	*Myctophum affine*	2J	22.2-31.5
N7	*Urophycis* sp(p)	2J	12.8-22.5
N8	*Gonichthys cocco*	1J	23.5
N8	*Hygophum benoiti*	1J	21.9
N8	*Urophycis* sp(p)	2J	15.0-20.0
N8	Scorpaenidae	1L	6.4
N8	*Decapterus punctatus?*	1J	18.0
N8	*Coryphaena hippurus*	1J	25.9
N8	*Abudefduf saxatilus*	2J	15.1-22.7
N8	*Monacanthus setifer*	1J	12.0
N9	*Centrobranchus nigroocellatus*	1J	13.9
N9	*Gonichthys cocco*	1A	25.0
N9	*Hygophum benoiti*	1A	36.5
N9	*Coryphaena hippurus*	1J	42.6
N9	*Monacanthus hispidus*	1J	19.5
N9	*Sphoeroides* sp	1J	11.6
N10	*Trachinocephalus myops*	2L	26.1-31.6
N10	*Urophycis* sp(p)	2J	10.0-10.7
N10	*Sphoeroides* sp	6J	6.6-14.5
N11	*Centrobranchus nigroocellatus*	1J,1A	18.0-27.2
N11	*Gonichthys cocco*	1J,33A	22.5-42.3

Table 6. Summary list by family of the fishes available from four cruises to Deepwater Dumpsite 106 in 1978. Their numbers and developmental stages follow each taxon. A dash (-) indicates none of the taxon for that cruise. A check (✓) after a taxon indicates a shelf taxon and two checks (✓✓) a southern taxon. Taxa with no checks are oceanic.

	February	April	June	November
ANGUILLIDAE				
Anguilla rostrata	-	-	-	2L
NETTASTOMATIDAE				
Hoplunnis sp. ?	-	1L	-	-
CONGRIDAE				
Unidentified	-	-	-	1L
OPHICHTHIDAE				
Ophichthus melanoporus	-	1L	-	-
CLUPEIDAE				
Harengula jaguana ? (✓) (✓✓)	-	-	-	2L
ENGRAULIDIDAE				
Engraulis eurystole (✓) (✓✓)	-	1J	-	3L
GONOSTOMATIDAE				
Gonostoma elongatum	-	-	2L	-
PHOTICHTHYIDAE				
Vinciguerria nimbaria	-	-	-	2L
ASTRONESTHIDAE				
Astronesthes niger	3A	-	-	-
SYNODONTIDAE				
Sauridae sp. (✓) (✓✓)	-	1L	-	-
Trachinocephalus myops (✓) (✓✓)	-	-	-	2L
Unidentified	-	-	-	1L
PARALEPIDIDAE				
Lestidium atlanticum	-	-	-	1L
Notolepis rissoi	-	-	2L	1L
Sudis hyalina	-	-	-	1L
MYCTOPHIDAE				
Benthosema glaciale	-	1A	7L,5J,1A	-
Benthosema suborbitale	-	-	-	1J
Centrobranchus nigroocellatus	5J	-	6J	4J
Ceratoscopelus maderensis	1J	-	17L	19L,2J
Ceratoscopelus warmingii	-	-	-	2L
Diaphus dumerilii	16J,6A	-	2J	2J
Diaphus rafinesquii?	-	-	-	1J
Diaphus taaningi	-	1J	-	1L,1J
Diaphus sp.	-	-	-	1L
Diogenichthys atlanticus	-	-	-	1J
Gonichthys cocco	24J,8A	-	16J,25A	7J,60A
Hygophum benoiti	-	-	-	5J
Hygophum hygomii	2J	3J	2J	1A
Hygophum reinhardtii	-	-	1J	2J
Hygophum taaningi	-	-	1J	-
Hygophum spp.	-	-	5L	1J
Lampanyctus alatus	-	-	-	1J
Lampanyctus sp.	-	-	1L	-
Lepidophanes guentheri	-	-	1J	3J
Myctophum affine	6J,1A	-	64J,1A	12J,6A
Myctophum asperum	11J	1J	5J	-
Myctophum nitidulum	18J	-	18J	-

Table 6. (continued)

	February	April	June	November
Myctophum obtusirostre	16J	-	-	-
Myctophum punctatum	6A	30A	-	-
Myctophum selenops	-	-	1J	-
Myctophum spp.	-	1L	-	1L
Notolychnus valdivae	-	1J,1A	-	1J
Notoscopelus resplendens	3J,1A	-	-	-
Symbolophorus veranyi	27J,4A	13J	4J,1A	1J
Unidentified	-	3L	13L	-
LOPHIIDAE				
Lophius americanus? (✓)	-	3L	4L	-
ANTENNARIIDAE				
Unidentified	-	1L	-	-
GADIDAE				
Enchelyopus cimbrius (✓)	-	-	-	1J
Urophycis sp(p) (✓)	6J	8L	4L,23J	188L,364J
MERLUCCIDAE				
Merluccius bilinearis? (✓)	-	1L	-	-
CARAPODIDAE				
Carapus bermudensis (✓✓)	-	1L	-	5L
MACROURIDAE				
Unidentified	-	2L	-	-
EXOCOETIDAE				
Cypselurus melanurus (✓✓)	-	-	-	1J
Euleptorhamphus velox (✓✓)	-	-	-	1J
Prognichthys gibbifrons (✓✓)	-	-	1J	-
SCOMBERESOCIDAE				
Scomberesox saurus	-	1J	2L,5J	-
SYNGNATHIDAE				
Hippocampus erectus (✓)	-	1A	-	-
Unidentified	-	-	-	1J
SCORPAENIDAE				
Unidentified	-	2L	-	1L
TRIGLIDAE				
Prionotus sp. (✓)	-	1L	-	-
SERRANIDAE				
Centropristis striata (✓)	-	1L	-	-
Diplectrum sp. (✓✓)	-	1L	-	-
Unidentified	-	-	-	1L
POMATOMIDAE				
Pomatomus saltatrix (✓)	-	-	2J	-
CARRANGIDAE				
Decapturus punctatus? (✓)	-	-	-	1J
Oligoplites saurus (✓)	-	-	1J	-
Seriola dumerili (✓✓)	-	-	4J?	3J
Seriola fasciata? (✓✓)	-	-	4J	-
Seriola zonata? (✓✓)	-	-	1J	-
Seriola sp.	-	-	-	2L

Table 6. (continued)

	February	April	June	November
CORYPHAENIDAE				
Coryphaena hippurus	-	-	-	5J
GERRIDAE				
Eucinostoma gula? (✓)	-	-	-	5L
MULLIDAE				
Mullus auratus (✓)	-	-	-	1L,4J
POMACENTRIDAE				
Abudefduf saxatilis (✓✓)	-	-	-	3J
MUGILIDAE				
Mugil cephalus (✓)	3J	2J	1J	-
Mugil curema (✓)	2J	-	4J	1L,3J
LABRIDAE				
Unidentified (✓)	-	-	-	4L
SCARIDAE				
Unidentified (✓✓)	-	-	-	7L
BLENNIIDAE				
Parablennius marmoreus? (✓)	-	-	1J	-
AMMODYTIDAE				
Ammodytes sp. (✓)	-	178L	-	-
CALLIONYMIDAE				
Callionymus sp. (✓✓)	-	-	-	2L
GOBIIDAE				
Unidentified (✓)	-	-	-	5L
TRICHIURIDAE				
Diplospinus multistriatus	-	-	-	1L
Unidentified	-	-	-	1L
STROMATEIDAE				
Peprilus triacanthus (✓)	-	10L,1J	1J	-
BOTHIDAE				
Bothus sp(p) (✓)	-	2J	-	21L
Citharichthys sp. (✓)	-	2L	-	-
Etropus microstomus? (✓)	-	-	-	2L
Syacium papillosum (✓)	-	-	-	4L
CYNOGLOSSIDAE				
Symphurus sp. (✓)	-	-	-	1L
BALISTIDAE				
Balistes capriscus	-	-	-	1J
Canthidermis sufflamen	-	-	1J	1J
Monacanthus hispidus	-	-	14J	7J
Monacanthus setifer	-	-	-	1J
TETRAODONTIDAE				
Sphoeroides sp.	-	-	19J	42J

Table 7. List of fishes by cruise in 61-cm bongo nets at 39°07'N-72°11'W from 1974 to 1976 MARMAP surveys. Times and dates are in Greenwich Mean Time. Numbers of specimens, in developmental stages (L=larval, J=juvenile, A=adult), size ranges (lengths in millimeters), and numbers calculated for 10 square meters follow each taxon.

Cruise	Start Time	Date	Taxon	No. and Stage	Size Range	No./10m^2
DL-74-07	1343	27-VII-74	*Ophichthys* sp.	2L	7.5 & 11.5	7.00
			Notolepis rissoi	1L	11.5	3.50
			Brosme brosme	1L	-	3.50
			Bothus sp.	1L	16.5	3.50
			Citharichthys arctifrons	1L	3.5	3.50
DL-74-08	1605	19-VIII-74	Gobiidae sp.	1L	6.5	4.08
			Bothus sp(p)	2L	4.5 & 8.5	8.16
			Citharichthys arctifrons	1L	6.5	4.08
DL-74-11	1420	26-IX-74	*Maurolicus muelleri*	1L	5.5	7.05
			Notolepis rissoi	2L	3.5 & 20.5	14.10
			Urophycis sp(p)	11L	3.5-10.5	77.55
			Ophidiidae	1L	-	7.05
			Citharichthys arctifrons	3L	3.5-4.5	21.15
DL-74-13	2030	26-X-74	*Maurolicus muelleri*	1L	6.5	5.51
			Urophycis sp.	1L	7.5	5.51
			Bothus sp.	1L	9.5	5.51
DL-75-01	1912	4-II-75	*Notolepis rissoi*	1L	15.5	3.45
			Paralepis coregonoides	5L	11.5-17.5	17.25
AT-75-07	0002	12-VII-75	*Conger oceanicus*	1L	44.5	5.00
			Sphoeroides sp.	1J	10.5	5.00
AT-75-08	0230	16-VIII-75	*Engraulis eurystole*	1L	10.5	6.97
			Lestidium atlanticum	1L	22.5	6.97
			Ceratoscopelus maderensis	3L	4.5-6.5	20.92
			Myctophum affine	1L	9.5	6.97
			Myctophum punctatum	1L	6.5	6.97
			Carapus bermudiensis	1L	9.5	6.97
			Gobiidae	1L	7.5	6.97
			Auxis sp(p)	2L	8.5 & 9.5	13.94
			Nomeidae sp.	1L	3.5	6.97
			Bothus sp(p)	3L	6.5-11.5	20.91
DL-75-14	0508	13-IX-75	*Benthosema glaciale*	1L,1J	7.5 & 39.5	4.98
			Ceratoscopelus maderensis	17L,1J	4.5-16.5	44.84
			Labridae	1L	12.5	2.49
DL-76-07	0600	23-V-76	Myctophidae sp.	1A	55.5	7.40
DL-76-10	0820	11-VI-76	*Benthosema glaciale*	7L,2J	5.5-22.5	56.79

Table 8. Summary list of fishes by month from 61-cm bongo collections taken 11.2 km north of DWD 106 from 1974-76. Their numbers and developmental stages (L=larval, J=juvenile, A=adult) follow each taxon. A dash (-) indicates none of the taxon for that month. No samples were taken in January and December. A check (✓) after a taxon indicates a shelf taxon; and two checks (✓✓) a southern taxon. Taxa with no checks are oceanic.

	February	March	April	May	June	July	August	September	October	November
CONGRIDAE										
Conger oceanicus	-	-	-	-	-	1L	-	-	-	-
OPHICHTHIDAE										
Ophichthys sp(p)	-	-	-	-	-	2L	-	-	-	-
ENGRAULIDIDAE										
Engraulis eurystole	-	-	-	-	-	-	1L	-	-	-
STERNOPTYCHIDAE										
Maurolicus muelleri	-	-	-	-	-	-	-	1L	-	-
PARALEPIDIDAE										
Lestidium atlanticum	-	-	-	-	-	-	1L	-	-	-
Notolepis rissoi	1L	-	-	-	-	1L	-	2L	-	-
Paralepis coregonoides	5L	-	-	-	-	-	-	-	-	-
MYCTOPHIDAE										
Benthosema glaciale	-	-	-	-	6L,2J	-	-	1L,1J	-	-
Ceratoscopelus maderensis	-	-	-	-	-	-	2L,1?	17L,1J	-	-
Myctophum affine	-	-	-	-	-	-	1L	-	-	-
Myctophum punctatum	-	-	-	-	-	-	1L	-	-	-
Unidentified	-	-	-	1A?	-	-	-	-	-	-
GADIDAE										
Brosme brosme (✓)	-	-	-	-	-	1L	-	-	-	-
Urophycis sp(p) (✓)	-	-	-	-	-	-	-	11L	1L	-
OPHIDIIDAE										
Unidentified	-	-	-	-	-	-	-	1L	-	-

Table 8. Continued

	February	March	April	May	June	July	August	September	October	November
CARAPODIDAE										
Carapus bermudensis (✓✓)	-	-	-	-	-	-	1L	-	-	-
LABRIDAE										
Unidentified	-	-	-	-	-	-	-	1L	-	-
GOBIIDAE										
Unidentified (✓)	-	-	-	-	-	-	2L	-	-	-
SCOMBRIDAE										
Auxis sp.	-	-	-	-	-	-	2L	-	-	-
BOTHIDAE										
Bothus sp(p) (✓)	-	-	-	-	-	1L	5L	1L	-	-
Citharichthys arctifrons (✓)	-	-	-	-	-	1L	1L	3L	-	-
NOMEIDAE										
Unidentified	-	-	-	-	-	-	1L	-	-	-
TETRAODONTIDAE										
Sphoeroides sp (✓)	-	-	-	-	1J	-	-	-	-	-